DESCRIPTION

METHOD OF ACCURATELY POSITIONING ANCHOR BOLT TO FOUNDATION BY SWING-TYPE ANCHOR BOLT

Technical Field

The present invention relates to a method of accurately positioning an anchor bolt to be embedded in foundation concrete of various building structures by a swing-type anchor bolt.

Background Art

In foundations of various building structures, it is necessary to provide an anchor bolt for firmly connecting the foundation and building frame of an upper structure to be installed thereon at the time of construction. The anchor bolt is a member whose lower portion is to be embedded in the foundation in a state in which an upper portion thereof projected from an upper surface of the foundation, as is needless to say.

In residential construction built by a conventional construction method, through holes for anchor bolts opening on bed-sills have been formed by measuring positions of the anchor bolts extending upright from a top end of the foundation individually, marking the positions on groundwork before installation, and drilling the marked positions at a

building site. Therefore, installation of the bed-sill to the top end of the foundation is enabled only after such a troublesome work, and is a very inefficient work.

In contrast, even in the case of the conventional construction method, when the through holes for the anchor bolts are drilled in advance when pre-cutting the bed-sills, and the carried bed-sills are installed on the top end of the foundation quickly in the building site, the efficiency is significantly improved. Of course, realization of this method is premised on accurate positioning of the anchor bolt projecting from the top end of the foundation and accurate adjustment of the same.

In prefabricated buildings or steel-frame buildings, superstructures are fabricated in a factory, and hence flexibility at the building site is extremely low. Therefore, accurate installation of the anchor bolts to the foundations for connecting with these structures is also required.

When installing such an anchor bolt to the foundation, a method of stretching a leveling line above the top end of a rising portion of the foundation horizontally from temporary reference construction along its reference center line, driving the anchor bolts along the leveling line in sequence while measuring dimensions based on a drawing, and fixing the anchor bolts to a concrete form in a driven state

by supporting means is widely used. Since this method must be completed within a relatively short time until concrete is hardened, the procedures are hurriedly performed, and hence measurement may be inaccurate. Therefore, omission of implantation the anchor bolt may often occur as it stands now. In addition, with this method, the temporary reference construction which serves as a reference of measurement can be displaced with a slight external force, and hence there is a problem such that the reliability of the temporary reference construction which serves as a reference cannot be secured. Furthermore, there is also a problem such that the temporary reference construction becomes an obstacle of various works.

As an improvement of this method, a technique disclosed in Patent Document 1 is proposed. Instead of the temporary reference construction, it is placed in a standing manner on an outside of a corner of the foundation concrete form including a supporting leg which can be adjusted in height freely, and a hooking portion for the leveling line arranged on a L-shaped side plate at an upper end thereof so as to be capable of sliding in the horizontal direction. This technique has no difference from the conventional technique except for a point that replacement of the leveling line can easily be performed. Therefore, the problems described above are not solved at all.

There are other techniques proposed in particular for mounting the anchor bolt accurately to the foundation as shown below.

One of them is aiming at accurately positioning the anchor bolt by fixing the same to concrete form via the supporting means, and is proposed in Patent Document 2 and Patent Document 3. However, the proposal of Patent Documents 2 and 3 are both premised on accuracy of concrete form for building the foundation, and aim at improvement of mounting accuracy of the anchor bolt to an anchor bolt supporting member or an anchor bolt holding member mounted directly or indirectly thereto. However, it seems that required positioning accuracy of the anchor bolt cannot be achieved sufficiently in a practical sense.

The concrete form for building the foundation is, as long as it is the one currently used, not able to avoid slight displacement due to a high pressure exerted when casting concrete. Therefore, in spite of increase of positioning accuracy in support of the anchor bolt supporting member itself, displacement occurs on the side of concrete form and, accordingly, displacement of the anchor bolt supporting member itself may be resulted. Furthermore, the high pressure exerted when casting concrete is also exerted to the anchor bolt which is supported by the supporting member or the like. Therefore, the supporting

member cannot support the pressure, and hence slight displacement cannot be avoided unless it has a substantially solid structure.

Therefore, with the technique in which the anchor bolt is fixed to the concrete form via the supporting means as shown in Patent Documents 2 and 3, the positioning accuracy cannot be improved sufficiently.

Alternatively, there are other techniques proposed in Patent Document 4 and Patent Document 5, in which the lower portion is fixed to an understructure such as an anchor plate having an anchor bolt holding member or a fixing leg, and the upper portion is fixed to the superstructure such as a positioning plate or a positioning jig so as to construct a solid anchor frame, and then the understructure is fixed to leveling concrete or the like, thereby positioning the anchor bolt at a predetermined position.

The objects of the Patent Documents 4 and 5 are, to provide a positioning plate in which an upper end screw portion of the anchor bolt can be inserted and removed easily for the former, and to improve workability by suspending plumb bobs from four sides of a jig body of the superstructure for the latter. However, as described above, both of the techniques are premised on the technique to realize the accurately positioning the anchor bolt by constructing the solid anchor frame as described above.

The anchor frames shown in Patent Documents 4 and 5 are constructed extremely solidly, and hence they can resist the pressure from the concrete to be cast and can maintain the accuracy relatively easily when it is accurately positioned. However, in such a structure, the longer the anchor bolt becomes, the higher strength of the frame is required. Therefore, the cross-section of the frame further increases, and the weight also increases correspondingly, whereby workability is deteriorated and hence increase in cost cannot be avoided.

There is also a technique in which the anchor bolt is supported by reinforcing steel for reinforcing the foundation. However, such reinforcing steel is displaced easily and significantly when casting concrete. Therefore, it should be said that the reinforcing steel is almost of no use.

Patent Document 1: Japanese Unexamined Utility Model Registration Application No.5-38036

Patent Document 2: Japanese Unexamined Patent Application Publication No.2002-242201

Patent Document 3: Japanese Unexamined Patent Application Publication No.2000-54397

Patent Document 4: Japanese Unexamined Patent Application Publication No.2000-352120

Patent Document 5: Japanese Unexamined Patent Application

Publication No.5-141095

Disclosure of Invention

Problem to be Solved by the Invention

It is an object of the present invention to solve the above-described problems in the related art and provide a method of accurately positioning an anchor bolt to a foundation that can realize accurately positioning the anchor bolt to the foundation with a simple procedure without using a temporary reference construction and using a member of an extremely simple structure.

Means for Solving the Problem

A first aspect of the present invention is a method of accurately positioning an anchor bolt to a foundation by a swing-type anchor bolt including the steps of:

fixedly installing anchor bolt mounting means on leveling concrete so as to be aligned with a center mark for the anchor bolt positioned and indicated thereon;

mounting the anchor bolt to the anchor bolt mounting means so that an axial center is aligned with the center mark in a state of extending in a vertical state via a hinge member which can be bend in any directions through 360°;

casting concrete for a base portion and a rising portion of the foundation simultaneously; and

adjusting the anchor bolt that may have inclined at the time of casting to the vertical state before the concrete is hardened, and maintaining the vertical state by holding means.

A second aspect of the present invention is a method of accurately positioning an anchor bolt to a foundation by a swing-type anchor bolt including the steps of:

fixedly installing anchor bolt mounting means on leveling concrete so as to be aligned with a center mark of an outer periphery of a mat foundation for the anchor bolt positioned and indicated thereon;

mounting the anchor bolt to the anchor bolt mounting means so that an axial center is aligned with the center mark in a state of extending in a vertical state via a hinge member which can be bent in any directions through 360°;

casting concrete for a base portion;

adjusting the anchor bolt that may have inclined at the time of casing to the vertical state before the concrete is hardened, and maintaining the vertical state thereof until the concrete is hardened by holding means; and

removing the holding means and casting concrete for a rising portion.

A third aspect of the present invention is a method of accurately positioning an anchor bolt to a foundation by a swing-type anchor bolt including the steps of:

fixedly installing anchor bolt mounting means on leveling concrete so as to be aligned with a center mark for the anchor bolt positioned and indicated thereon;

casting concrete for a base portion of the foundation to a level of a midpoint of an extension shaft extending upright from an immediately above the center mark, the extension shaft extending from the anchor bolt mounting means;

mounting the anchor bolt to an upper end of the extension shaft of the anchor bolt mounting means so that an axial center and an axial center are aligned with each other in a state of extending in a vertical state via a hinge member which can be bent in any directions through 360°;

casting concrete for a rising portion of the foundation; and

adjusting the anchor bolt which may have inclined at the time of casting to the vertical state before the concrete is hardened, and maintaining the vertical state by holding means.

A fourth aspect of the present invention is a method of accurately positioning an anchor bolt to a foundation by a swing-type anchor bolt including the steps of:

mounting unit mounting means for an anchor bolt unit on leveling concrete so that an axial center of a reference center shaft of the anchor bolt unit connected in a

positional relation which is to be achieved when the plurality of anchor bolts are mounted to the foundation is aligned vertically with a center mark for the reference center shaft of the anchor bolt unit positioned and indicated thereon when the reference center shaft is disposed upright in a vertical state;

mounting the anchor bolt unit to the unit mounting means so that the axial center is aligned with the center mark in a state in which the reference center shaft is extended upright in the vertical state via a hinge member which can be bent in any directions through 360°;

casting concrete for a base portion and a rising portion of the foundation simultaneously; and

adjusting the reference center shaft to the vertical state to adjust the anchor bolt unit that may have inclined at the time of casting to the vertical state before the concrete is hardened, and maintaining the vertical state by holding means.

A fifth aspect of the present invention is the method of accurately positioning an anchor bolt to a foundation by a swing-type anchor bolt according to the first, second, third, or fourth aspect of the present invention, wherein the center mark is positioned and indicated on the leveling concrete in reference to directly a reference center of a building.

A sixth aspect of the present invention is the method of accurately positioning an anchor bolt to a foundation by a swing-type anchor bolt according to the first, second, third, or fourth aspect of the present invention, wherein the height adjusting member is interposed immediately above or below.

A seventh aspect of the present invention is the method of accurately positioning an anchor bolt to a foundation by a swing-type anchor bolt according to the fourth aspect of the present invention, wherein the reference center shaft is formed of a shaft body constituting an outer layer and a core member of a small diameter constituting an axial center thereof and is adapted to be cut at any position in a longitudinal direction.

An eighth aspect of the present invention is the method of accurately positioning an anchor bolt to a foundation by a swing-type anchor bolt according to the first, second, third, fourth, fifth, sixth, or seventh aspect of the present invention including the steps of indicating a reference center line of the foundation on the leveling concrete in reference to the reference center of the building, fabricating a center mark indication tape which indicates a reference center line to be aligned with the reference center line and the center mark for the anchor bolt or the center mark for the reference center shaft which

has a predetermined positional relation therewith in advance; and adhering the center mark indication tape on the leveling concrete so as to align the center mark indication tape with the reference center line, thereby indicating the respective center marks.

A ninth aspect of the present invention is the method of accurately positioning an anchor bolt to a foundation by a swing-type anchor bolt according to the first, second, or third aspect of the present invention, wherein the hinge member is formed of a flexible tube member having insertion joint ends at both ends.

A tenth aspect of the present invention is the method of accurately positioning an anchor bolt to a foundation by a swing-type anchor bolt according to the fourth aspect of the present invention, wherein the hinge member is formed of resilient material having joint ends at both ends.

An eleventh aspect of the present invention is the method of accurately positioning an anchor bolt to a foundation by a swing-type anchor bolt according to the sixth aspect of the present invention, wherein the height adjusting member is a turn buckle type height adjusting member including an adjusting member body for adjusting the length by being rotated and screw members having thread in the opposite direction from each other screwed into the adjusting member body from both ends or a piston type height

adjusting member including a cylindrical adjusting member body, two piston members inserted from both ends thereof so as to be capable of back and forth movement, rod members connected to the two piston member so as to project from both ends of the cylindrical adjusting member body, two or more fixing screws screwed on a peripheral side of the cylindrical adjusting member body, the two or more fixing screws being screwed to peripherals side of the piston members for fixing the position thereof.

The twelfth aspect of the present invention is the method of accurately positioning an anchor bolt to a foundation by a swing-type anchor bolt according to the first, second, third, or fourth aspect of the present invention, wherein a plummet instrument for measuring the verticality of the anchor bolt or the reference center shaft of the anchor bolt unit is used for adjusting the anchor bolt or the anchor bolt unit to the vertical direction, and the plummet instrument includes a pipe member for fitting on the anchor bolt or the reference center shaft and a verticality measuring section provided on an upper end thereof.

A thirteenth aspect of the present invention is the method of accurately positioning an anchor bolt to a foundation by a swing-type anchor bolt according to the twelfth aspect of the present invention, at least an upper

portion of the anchor bolt which is fitted into the pipe member of the plummet instrument is corrected to be a circle having a center on an axial center in plan view before use so as to be fitted on the pipe member smoothly without being decentered and without looseness.

A fourteenth aspect of the present invention is the method of accurately positioning an anchor bolt to a foundation by a swing-type anchor bolt according to the second aspect of the present invention, wherein the holding means including two band-shaped holding strips connected so as to be capable of being bent at a midpoint thereof, an anchor holding hole opening at a bent center portion; and magnetized portions arranged at positions near both ends of the respective band-shaped holding strips is employed, the anchor bolt corrected to the vertical state is fitted in the anchor holding hole, and the two band-shaped holding strips are opened into a V-shape so that the magnetized portions at both ends can be fixedly attached to a concrete frame formed of magnetic metal.

Advantages of the Invention

According to the first, second, third, and fourth aspects of the present invention, accurate and quick positioning of the anchor bolt on the foundation is realized in a simple procedure using members of an extremely simple

structure without using a temporary reference construction.

In addition by securing the verticality of the anchor bolt or the reference center shaft using the plummet instrument, the immovable center mark on the leveling concrete can be moved to the top end of the foundation with a high degree of accuracy.

Since the necessity of the temporary reference construction is eliminated, there is no obstacle in the area around the site of the foundation work, whereby incoming and outgoing of vehicles, movement of a construction machine, or various works can be performed extremely easily.

According to the fifth aspect of the present invention, the center mark can be positioned and indicated on the leveling concrete accurately without using the temporary reference construction.

According to the sixth aspect of the present invention, the height of the anchor bolt to be positioned and installed can be adjusted easily.

According to the seventh aspect of the present invention, after the anchor bolt is positioned by the anchor bolt unit, the core member of a small diameter which constitutes the axial center of the reference center shaft appears on a cross-sectional surface thereof which appears at the top end of the rising portion of the foundation, and hence it can be used as an original point of the reference

center line to be indicated on the top end of the rising portion of the foundation.

According to the eighth aspect of the present invention, only by achieving the positioning for some of reference center lines which are important with level or transit, other center marks can be positioned and indicated on the leveling concrete extremely easily and quickly using the center mark display tape.

According to the ninth and tenth aspects of the present invention, the structure of the rising portion in which the anchor bolt or the anchor bolt unit can be tilted freely can be realized easily and reliably.

According to the eleventh aspect of the present invention, the height of the anchor bolt can be adjusted easily as needed. The structure is also simple.

According to the twelfth aspect of the present invention, measurement of the verticality of the anchor bolt or the reference center shaft can be performed easily and quickly with a simple instrument.

According to the thirteenth aspect of the present invention, the verticality of the anchor bolt can be secured more accurately, and hence the accuracy of the positioning of the anchor bolt is further enhanced.

According to the fourteenth aspect of the present invention, even when there is an adjacent concrete frame

only on one side such as a case after concrete for the base portion on the outer peripheral portion of the mat foundation is cast, the anchor bolt which is corrected in inclination and secured in its verticality can be maintained in this state easily and reliably.

Brief Description of the Drawings

Fig. 1(a) is an explanatory front view, partly broken, of Example 1 showing a state in which an anchor bolt is being mounted to a mounting member via a hinge member and a turn buckle member, and Fig. 1(b) is an explanatory front view, partly broken, of Example 1 showing a state in which the anchor bolt is mounted to the mounting member via the hinge member and the turn buckle member.

Fig. 2 is an explanatory front view, partly broken, of Example 1 showing a state in which concrete is cast in an area where the anchor bolt mounted to the mounting member via the hinge member and the turn buckle member is installed.

Fig. 3 is an explanatory cross-sectional view, partly broken, of a rising portion of a foundation in Example 1 showing a state in which a vertical state of the anchor bolt is maintained by a verticality holder until the concrete is hardened.

Fig. 4 is an explanatory cross-sectional view, partly broken, of the foundation in Example 1 after the concrete is

hardened.

Fig. 5 is an explanatory front view, partly broken, of Example 2 showing a state in which the anchor bolt is mounted to an extension shaft of the mounting member via the hinge member and the turn buckle member.

Fig. 6(a) is an explanatory cross-sectional view, partly broken, of Example 2 showing a state in which a ball head lock nut provided with an extension shaft extending upright is about to be screwed into a hollow bolt of the mounting member on leveling concrete, and Fig. 6(b) is an explanatory cross-sectional view, partly broken, of Example 2 showing a state in which the ball head lock nut provided with the extension shaft extending upright is screwed into the hollow bolt of the mounting member on the leveling concrete.

Fig. 7 is an explanatory cross sectional view, partly broken, of Example 2 showing a state in which concrete for a base portion is cast in an area in which the extension shaft extended upright from the mounting member is disposed.

Fig. 8 is an explanatory cross-sectional view, partly broken, of Example 2 showing a state in which the anchor bolt is about to be mounted to a volute joint projected from the concrete for the base portion of the extension shaft extended upright from the mounting member via the hinge member and the turn buckle member.

Fig. 9 is an explanatory cross-sectional view, partly broken, of Example 2 showing a state n which concrete for a rising portion of the foundation is cast in the area where the anchor bolt is installed from the extension shaft via the hinge member and the turn buckle member.

Fig. 10(a) is an explanatory cross-sectional view of Example 3 showing a state in which a mounting hole is formed in leveling concrete with a drill, Fig. 10(b) is an explanatory cross-sectional view of Example 3 showing a state in which a plug is fitted in the mounting hole drilled in the leveling concrete, Fig. 10(c) is an explanatory cross-sectional view of Example 3 showing a state in which the extension shaft provided with a screw member at a lower end thereof is screwed into the mounting hole drilled in the leveling concrete and fitted with the plug, and Fig. 10(d) is a plan view of the extension shaft in Example 3.

Fig. 11 is an explanatory cross-sectional view, partly broken, of Example 3 showing a state in which a reinforcing pipe is fitted on the extension shaft extended upright from the mounting hole in the leveling concrete.

Fig. 12 is an explanatory cross-sectional view, partly broken, of Example 3 showing a state in which the reinforcing pipe is fitted on the extension shaft extended upright from the mounting hole in the leveling concrete and a plummet instrument is fitted thereover.

Fig. 13(a) is an explanatory front view, partly broken, of Example 4 showing a state in which an anchor bolt unit is mounted to the mounting member, and Fig. 13(b) is an explanatory front view, partly broken, of Example 7 showing a state in which the anchor bolt unit is mounted to the mounting member, and Fig. 13(c) is an explanatory front view, partly broken, of Example 8 showing a state in which the anchor bolt unit is mounted to the mounting member.

Fig. 14 is an enlarged explanatory plan view of the mounting member according to Example 1 and Example 2.

Fig. 15(a) is an explanatory cross-sectional view of the mounting member according to Example 5, and Fig. 15(b) is an explanatory cross-sectional view of the mounting member according to Example 6.

Figs. 16(a) to (f) are explanatory plan views showing examples of a center mark indication tape used in the respective Examples.

Fig. 17(a) is a general perspective view of an inspection tool for the plummet instrument according to Example 10 with the plummet instrument shown adjacently thereto, and Fig. 17(b) is a general perspective view of the inspection tool for the plummet instrument according to Example 11.

Fig. 18(a) is a general front view of a verticality holder used in the respective Examples, Fig. 18(b) is a

general side view of the verticality holder used in the respective Examples, Fig. 18(c) is an explanatory plan view showing a state in which the anchor bolt is supported by the verticality holder and fixedly attached to concrete forms both sides in the respective Examples, and Fig. 18(d) is a general perspective view showing a state in which the anchor bolt is supported by the verticality holder and fixedly attached to one side of the concrete form in the respective Examples.

Fig. 19(a) is a general perspective view of the plummet instrument in Example 9, Fig. 19(b) is a general perspective view of an adaptor in Example 9, Fig. 19(c) is a general perspective view of the plummet instrument to which the adaptor in Example 9 is attached, Fig. 19(d) is an enlarged cross-sectional view taken along the line d-d in Fig. 19(a), and Fig. 19(e) is an enlarged cross-sectional view taken along the line e-e in Fig. 19(b).

Fig. 20(a) is a general front view in cross-section showing a state in which the plummet instrument is set to a reference center shaft of the anchor bolt unit in Example 9, Fig. 20(b) is a general front view in cross-section showing a state in which the plummet instrument with the adaptor mounted to the anchor bolt is attached to the mounting member via the hinge member and the turn buckle member according to Example 9.

Reference Numerals

1	mounting member (anchor bolt mounting means)
1a	base seat
1b	hollow bolt
1c	view hole
1d	sector shaped projection
1e	screw member
1f	flange body
2	leveling concrete
3	concrete screw
4	hinge member
5	turn buckle member (height adjusting member)
5a	screw member
5b	turn buckle member body
5c	screw member
5d	volute joint
6	anchor bolt
6a	flange member
6b	male screw
6c	nut
7	ball head lock nut
7a	volute joint
7b	extension shaft
7c	cross groove

8 concrete

9 plummet instrument

9a verticality measuring section

9b pipe member

10 verticality holder (holding means)

10a band-shaped holding strip

10b anchor holding hole

10c magnet

11 reinforcing pipe

11a reinforcing flange

12 template

13 reference center shaft

13a shaft body

13b shaft member

14 hinge member

15 auxiliary spring

16 anchor bolt unit

18 concrete for base portion

19 adaptor

19a flange body

19b adjusting pipe member

21 mounting member

21a taper member

21b cylindrical body

21c volute joint

21d bolt member

25 supporting pole

28 concrete for rising portion of foundation

29 inspection tool

29a float

29b set shaft

29c plumb bob shaft

31 mounting member

31a base seat

31b mounting nut

31c viewing hole

31d volute joint

31e volt member

35 supporting pole

35a damper

39 inspection tool

39a base plate

39b universal joint mechanism

39c set shaft

39d plumb bob shaft

ca center mark for anchor bolt

cs center mark for reference center shaft of anchor bolt unit

d drill

h screw hole

hm mounting hole

k concrete form

L1, L2 reference center line

m notched groove

n nut

p plug member

t1-t6 center mark indication tape

v v-shaped notch

Best Mode for Carrying Out the Invention

The present invention provides a method of accurately positioning an anchor bolt to a foundation by a swing-type anchor bolt based on the steps of indicating a center mark for an anchor bolt or for a reference center shaft of an anchor bolt unit on immovable leveling concrete, installing the anchor bolt or the anchor bolt unit on the leveling concrete so as to be capable of tilting freely with the anchor bolt itself or the reference center shaft of the anchor bolt unit aligned vertically with the center mark, casting concrete, adjusting the anchor bolt or the anchor bolt unit which may be inclined during casting of the concrete into a vertical state and moving the anchor bolt itself or the reference center shaft of the anchor bolt unit so as to be extend upright at a position matching vertically with the center mark before the concrete is hardened, and

maintaining the same in the vertical state by holding means until the concrete is hardened.

The present invention basically has a structure described above, and is used for positioning the anchor bolt in the same principle. However, more specifically, it is classified into two categories of positioning of the single anchor bolt and positioning of the anchor bolt unit having the plurality of anchor bolts combined with each other with a predetermined positional relation. The positioning of the single anchor bolt in the former case is further divided into two categories depending on whether casting of foundation concrete is performed separately for a base portion and a rising portion in two steps, or it is performed in one step without separating the procedure.

A difference between the positioning of the single anchor bolt and the positioning of the anchor bolt unit having the plurality of anchor bolts combined with each other is, as described above, that the vertical adjustment after casting of concrete is performed for the anchor bolt itself in the former case, while it is performed for the reference center shaft provided in the unit in the latter case. The latter case is of course configured to achieve efficient positioning by combining the plurality of anchor bolts together, and the practical mutual positioning principle is the same.

In the case in which the casting of concrete is performed in two steps, the positioning of the single anchor bolt is different between the case of an outer periphery of a mat foundation and the case of portions other than the outer periphery of the mat foundation and other types of foundations (continuous footing foundation, independent foundation, hybrid foundation, continuous foundation).

In the case in which the casting of concrete is performed in two steps and in the case of the portions other than the outer periphery of the mat foundation and the other types of foundations, it is necessary to provide an extension shaft which extends further upward from a top end of concrete to be cast for the base portion (concrete cast in the first step) on an anchor bolt mounting means to be installed corresponding to the center mark of leveling concrete, and also it should have a strength that can resist from displacement even by casting of the concrete for the base portion. On the other hand, in the case of the outer periphery of the mat foundation, it is not necessary to be like the case described above even in the case of casting concrete in two steps.

In the case in which the casting of concrete is performed in two steps and in the case of the portions other than the outer periphery of the mat foundation and the other types of foundations, the anchor bolt is mounted to the

extension shaft projecting from concrete for the base portion so as to be capable of tilting freely, concrete for the rising portion is cast, and subsequently, the anchor bolt is adjusted to the vertical state before the concrete is hardened, and then the anchor bolt is maintained in the vertical state by the holding means until the concrete is hardened. On the other hand, in the case of all the types of foundations other than the mat foundation and the casting of concrete is performed in one step, the anchor bolt is mounted while matching with the center mark of leveling concrete so as to be capable of tilting freely, concrete is cast both for the base portion and the rising portion, the anchor bolt is adjusted in the vertical state before the concrete is hardened, and maintained by simple holding means until the concrete is hardened.

In the case of the mat foundation, concrete for the base portion and concrete for the rising portion are cast in two steps. In the case of the outer periphery, the anchor bolt is disposed upright from the anchor bolt mounting means so as to be capable of tilting freely without providing the extension shaft on the anchor bolt mounting means as in the case of casting concrete in one step for the foundations other than the mat foundation, and concrete for the base portion is cast. Since concrete in the outer periphery of the mat foundation is as deep as concrete reaches the

midsection of the anchor bolt, inclination of the anchor bolt is corrected using a plummet instrument before the concrete is hardened and the verticality is secured, and then the verticality of the anchor bolt is maintained by the holding means.

When casting concrete for the base portion, since only an outer frame side of concrete form exists in the outer periphery of the mat foundation, it is preferable to employ holding means including two band-shaped holding strips connected so as to be bent at a midpoint thereof, an anchor holding hole opening at a bent center portion, and magnetized portions arranged at positions near both ends of the respective band-shaped holding strips as the holding means, so that the anchor bolt with the verticality secured is fitted in the anchor holding hole, and the two band-shaped holding strips are opened into a V-shape, thereby being fixedly attached to the outer concrete form with the magnetized portions at both ends. Since concrete frame employed is normally formed of magnetic metal, this adsorption joint using the magnetized portions is achieved.

In the outer periphery of the mat foundation, concrete for the rising portion is cast after the concrete for the base portion is hardened. However, since the anchor bolt is reliably fixed by the concrete for the base portion at this point of time, it is not necessary to fix the anchor bolt by

the holding means.

The principle of positioning is identical for any of the cases shown above. In the case in which concrete is cast in two steps and in the case of the portion other than the outer periphery of the mat foundation and the other types of foundations, the anchor bolt is mounted to the extension shaft so as to be capable of tilting freely when casting concrete for the rising portion. Therefore, unless the extension shaft is maintained in the vertical state and the reliably aligned relation with the center mark indicated on leveling concrete is maintained, accuracy of the positioning of the anchor bolt mounted thereon cannot be secured. Therefore, as described above, the anchor bolt mounting means to be mounted to the leveling concrete and the extension shaft must have a sufficiently high strength so as to avoid displacement even when the concrete for the base portion is cast.

Since the thickness of the concrete for the base portion in this case is significantly smaller than that of the rising portion, the pressure generated when casting concrete is not so high. On the other hand, since the extension shaft must simply play a role to extend the center mark on leveling concrete up to the top of the base concrete, it can be formed into a column shape which is not too thick, and the pressure exerted by concrete can be reduced as well.

Therefore, the strength required for the anchor bolt mounting means and the extension shaft does not affect the cost.

Anyway, in the present invention, it is firstly necessary to position the center mark for the anchor bolt or the center mark for the reference center shaft of the anchor bolt unit on leveling concrete, and indicate the same.

The leveling concrete is to be arranged entirely in a foundation building area or across a sufficient width along an installation line of the rising portion in advance.

Furthermore, the center mark for the anchor bolt or the center mark for the reference center shaft of the anchor bolt unit are to be positioned and marked and indicated by charcoal or other marking means on the leveling concrete directly from the reference center of the building. It is also possible to position the reference center line of the rising portion of the foundation from the reference center of the building, and indicate it on the leveling concrete, so that the center mark for the anchor bolt can be positioned with reference to the reference center line.

In this case, a center mark indication tape on which the reference center line to be aligned with the reference center line of the rising portion of the foundation and the center mark for the anchor bolt or the center mark for the reference center shaft of the anchor bolt unit which is to

be a specific positional relation with the reference center line are indicated is manufactured in advance, and the center mark indication tape is adhered on the leveling concrete while matching the reference center lines with each other, whereby the respective center marks can be indicated.

Subsequently, when the single anchor bolt is placed upright on the leveling concrete as described above, the anchor bolt mounting means is fixedly mounted so as to match the center mark. In the case of the foundations other than the mat foundation and in the case in which the casting of concrete is performed for the base portion and the rising portion in two steps in sequence as described above, the anchor bolt mounting means having the upright extension shaft of a length exceeding the thickness of the base portion is employed. When the casting of concrete for the base portion is performed simultaneously with that for the rising portion, such the extension shaft is not necessary.

In the case of portion other than the outer periphery of the mat foundation, concrete is cast in two steps, and it is completely the same as the case of providing on the foundation other than the mat foundation and of performing that for the base portion and for the rising portion in two steps in sequence.

The anchor bolt mounting means used in the case in which casting of concrete is performed in two steps needs to

have a higher strength than that used in the case in which it is performed in one step. However, there is no reason to differentiate the structure itself except for the point described above. In either cases, various structures may be employed freely while maintaining the required mounting strength.

For example, a structure including an ore anchor to be fixed by being struck into a mounting hole drilled in leveling concrete, and a shaft member connected thereto having connecting means with respect to a hinge member or a height adjusting member described later, a structure including a base seat to be fixed on leveling concrete with adhesive agent, a concrete nail, a concrete screw or the like, a nut member fixedly provided thereon, and a bolt member to be screwed into the nut member having the connecting means with respect to the hinge member or the height adjusting member described later, or a structure including the base seat to be fixed on leveling concrete with adhesive agent, the concrete nail, the concrete screw or the like, a hollow bolt member fixedly provided thereon, a ball head lock nut member to be screwed on the hollow bolt member having the connecting means with respect to the hinge member or the height adjusting member described later can be employed.

Alternatively, a structure including the base seat to

be fixed on leveling concrete with adhesive agent, the concrete nail, or the concrete screw or the like, one of coupler joints fixedly provided thereon, the other coupler joint to be disconnectably connected to the one of the coupler joints having the connecting means with respect to the hinge member or the height adjusting member described later, or a structure including a screw member to be screwed into a plug member press-fitted into the mounting hole drilled in leveling concrete, and connecting means with respect to the hinge member or the height adjusting member, described later, provided integrally with an upper end thereof can be employed.

The base seat described above is preferably formed with a viewing hole at a center thereof, so that it can be mounted while checking out the center mark when installing it on leveling concrete. Also, by providing two sector-shaped projecting strips so that the apexes thereof project in this viewing hole thereof so as to oppose to each other, further accurate matching of the centers is achieved by locating the sides of the two sector-shaped projecting strips in the viewing hole of the base seat along the intersecting reference center lines indicated thereon when installing the base seat on the leveling concrete.

When concrete is cast in two steps, the verticality of the extension shaft to be disposed upright on the mounting

means must be secured as described above, which must be measured at the time of installation and adjusted to be maintained. It may be achieved by using various types of plummet instruments, and there is no reason to use a specific one. However, in order to achieve higher efficiency, the plummet instrument including a pipe member that can be fitted on the extension shaft smoothly with little looseness and a verticality measuring section formed on an upper end thereof may be used.

The verticality measuring section may be those having an appropriate accuracy. However, a structure as simple as possible is preferred. For example, a structure in which the verticality is measured by an air ball in liquid positioned at a center of an upper surface may be employed.

The pipe member preferably has a diameter which allows fitting on the anchor bolt or the like to be measured smoothly with little looseness as described above, that is, an inner diameter which slightly exceeds the diameter of the anchor bolt or the like to be measured. In order to realize smoother insertion and removal, the inner diameter of the pipe member is formed slightly larger than the outer diameter of the anchor bolt or the like to be measured, and the inner surface thereof is formed with a plurality of projecting ridges extending along an axial direction over the entire inner periphery at regular angular intervals. In

this case, a diameter of a circle formed by connecting apexes of the plurality of projecting ridges is set to slightly exceed the outer diameter of the anchor bolt or the like to be measured. Since the surface area of the portions which come into contact with the outer periphery of the anchor bolt or the like when fitting is decreased, smoother insertion and removal are achieved. In addition, it is convenient to form a lower end of the pipe member so as to be widened gradually downward because it helps an upper end of the anchor bolt to be guided toward the center when being fitted on the anchor bolt or the like.

The pipe member of the plummet instrument is preferably formed to have the inner diameter which matches a diameter of an object to be measured having the largest outer diameter, and adapted to be used with the object to be measured with a smaller diameter by fitting an adapter to the pipe member. The adapter has an outer diameter corresponding to the inner diameter of the pipe member and an inner diameter corresponding to the outer diameter of the object to be measured. It is also convenient to form a plurality of projecting ridges on the inner periphery thereof as on the inner periphery of the pipe member as well for smooth insertion and removal of the object to be measured. It is preferable to provide an annular flange on an outer periphery at a lower edge and an entrance of the

lower edge is formed to be widened gradually downward.

As is understood from the description above, it is needless to say that the plummet instrument described above is used not only for measurement of verticality of the extension shaft, but also for measurement of verticality of the anchor bolt to be disposed upright from the extension shaft or the anchor bolt mounting means on leveling concrete or for measurement of verticality of the reference center shaft of the anchor bolt unit. It is also used in other various cases as a matter of course.

Subsequently, when casing concrete in two steps, concrete for the base portion is cast. Of course, it is premised that the concrete form for the base portion is separately provided. The concrete for the base portion is cast to a level near immediately below the upper end of the extension shaft extended upright from the anchor bolt mounting means. It is needless to say that the length of the extension shaft is set correspondingly.

Subsequently, when the concrete for the base portion is hardened to some extent, the anchor bolt is disposed upright on the upper end of the extension shaft via the hinge member. In addition to the hinge member, the height adjusting member is interposed immediately above or below when it is required. In the operation above, the anchor bolt is mounted to the extension shaft so that the axial centers match with each

other.

The hinge member is means which can be bent in any directions through 360° at this portion, and the structure is not specifically limited as long as it has such a function. For example, the hinge member can be formed of a flexible tube member having insertion joint ends at both ends. In this case, volute or helical joints are formed at the upper end of the extension shaft and the lower end of the anchor bolt respectively, so that connection is achieved by inserting the respective joints into the tube member from the corresponding ends. This joint can be reinforced by a band or the like as needed. It is also the same in the case of interposing the hinge member between the anchor bolt mounting means and the anchor bolt, and in this case, means like a connecting rod is disposed upright on the upper portion of the former, and the volute or helical joints are formed in the same manner on the upper end thereof or the lower end of the latter to achieve the same connection.

The hinge member may be formed of a flexible multi-layered rubber column or other resilient materials having joint ends at both ends. It is also possible to employ a single-layer rubber column as the resilient material. The hinge member of this structure is suitable for being interposed between the anchor bolt unit in which the plurality of anchor bolts are set together and the mounting

means thereof. Of course, depending on the size, it may be suitable for being interposed between the single anchor bolt and the extension shaft or the mounting means.

The height adjusting member is means for adjusting the height of the anchor bolt, and the structure is not specifically limited as long as this adjustment is possible. For example, the height adjusting member may be of a turn buckle type including an adjusting member body for adjusting the length by being rotated, and screw members having threads in opposite directions and screwed into the adjusting member body from both ends.

Alternatively, it may be of a piston type having a cylindrical adjusting member body, two piston members inserted from both ends thereof so as to be capable of back and forth movement, rod members connected to the two piston members and projecting from both ends of the cylindrical adjusting member body, two or more fixing screws screwed on a peripheral side of the cylindrical adjusting member body to be screwed until it reaches the periphery of the piston member for fixing the position thereof.

The anchor bolt is disposed upright on the extension shaft via the hinge member, and also the height adjusting member as needed, then the height is adjusted as needed, and then concrete for the rising portion of the foundation is cast. At this time, an additional concrete form for the

rising portion must be installed as a matter of course. This concrete form is configured along a line of the width of the foundation obtained by a foundation width scale in reference to the extension shafts at a plurality of positions. The concrete form can be constructed by efficient measurement as described above.

Casting of concrete as described above exerts a corresponding pressure to the anchor bolt. The anchor bolt is connected to the extension shaft at least via the hinge member as described above, and hence is able to be bent in any directions through 360°. Therefore, it is inclined by the pressure in the corresponding direction at a corresponding portion to release most part of the pressure, whereby a large external force is not exerted to the extension shaft. Therefore, the extension shaft and an anchor bolt mounting portion at the lower end thereof are maintained in the same state as it was initially installed on the leveling concrete, and the extension shaft is maintained in a state in which the upper end thereof is accurately positioned vertically above the center mark.

Subsequently, immediately, that is, before the concrete is hardened, the plummet instrument is set to the upper end of the anchor bolt to restore the anchor bolt into the vertical state while checking out the verticality measuring section of the plummet instrument, and the anchor bolt is

maintained in this state by the holding means until the concrete is hardened. The plummet instrument may be kept in the state of being set to the anchor bolt so that the verticality thereof can be checked out easily at the time of making the round, which is convenient.

The holding means is used for holding the anchor bolt until the concrete is hardened and, once it is set, there is no possibility of being exerted with a large external force unless there is something irregular, and hence the holding means of a simple structure is sufficient for holding the same. For example, a holding tool or the like including two band-shaped holding strips which can be bent at the center, and being formed with an anchor holding hole at a center of the bent portion may be employed. The one having magnets near both ends thereof so as to be capable of being fixed to the concrete form of magnetic metal of iron system is suitable.

When this holding means is used, the anchor holding hole is fitted to the portion near the upper end of the anchor bolt, and the both ends of the two holding strips are fixedly attached to the upper end of the concrete form by the magnet disposed thereon, so that the vertical state of the anchor bolt is maintained. The holding means is opened into a substantially linear state, and the both ends thereof are fixedly attached to the upper ends of the concrete forms

on both sides, or is bent into a V-shape and the both ends thereof are fixedly attached to the upper end of the concrete form on one side.

On the other hand, in the case of the continuous footing foundation or other foundations (the mat foundation is excluded) and in the case in which concrete is cast at once for both of the base portion and the rising portion in one casting step, the anchor bolt is connected via the hinge member, or the height adjusting member as needed without providing the extension shaft on the anchor bolt mounting means which is mounted on the leveling concrete so as to match the center mark as described above. The anchor bolt must be arranged so that the axial center thereof is aligned vertically with the center mark in the vertical state, as a matter of course.

The hinge member and the height adjusting member are those described above, and the method of connecting to each other is also the same.

Subsequently, concrete for the base portion and the rising portion of the foundation are cast at once, and the anchor bolt which is inclined thereby is restored to the vertical position using the plummet instrument. Then, the anchor bolt in the vertical state is maintained by the holding means until the concrete is hardened as described above. The holding means and the holding method are also

the same as those described above.

In either cases where concrete is cast in two steps and in one step, the anchor bolt is maintained in the vertical state maintained by the holding means as described above. However, the holding means is used merely for supplementarily supporting the anchor bolt until the concrete is hardened, and hence is simple in structure, so that it will not be a hindrance when adjusting the top end level of the rising portion of the foundation.

After the concrete has hardened, the holding means is removed from the anchor bolt, and if the plummet instrument is sill set thereon, it is also removed. Since the anchor bolt must have been kept in a relation in which the axial center thereof is aligned vertically with the center mark on the leveling concrete as long as it is kept in the vertical state at this moment, the anchor bolt is accurately positioned in the foundation with an extremely simple mounting operation.

In the case of the outer periphery of the mat foundation, casting of concrete is performed in two steps for the base portion and the rising portion as described above, the method of mounting the anchor bolt to the anchor bolt mounting means is the same as the case of the continuous footing foundation and other type of foundations (the mat foundation is excluded), and in the case in which

concrete is cast in one step. The anchor bolt is disposed upright on the anchor bolt mounting means so as to be capable of tilting freely via the hinge member or the like and then concrete for the base portion is cast.

Since the concrete reaches up to the midsection of the anchor bolt in the outer periphery of the mat foundation, the plummet instrument is set to the upper end of the anchor bolt before the concrete is hardened, and the anchor bolt inclined due to the casting of the concrete is corrected to the vertical state. Whether it is corrected to the vertical state or not is checked with the plummet instrument. The anchor bolt whose verticality is secured is maintained in its vertical state by the holding means as described above.

After the concrete for the base portion is hardened, the holding means is removed and then concrete for the rising portion is cast. At this moment, since the anchor bolt is firmly held by the concrete for the base portion, there is no possibility to be inclined by the casting of the concrete for the rising portion.

In this manner, in the outer periphery of the mat foundation, the anchor bolt can be positioned upright accurately with the extremely simple operation.

In the case in which the anchor bolt unit including the plurality of anchor bolts set together is disposed upright on the leveling concrete, the unit mounting means for

mounting the anchor bolt unit is fixedly installed while being aligned with the center mark for the reference center shaft.

The anchor bolt unit includes the plurality of anchor bolts joined in the same positional relation as the positional relation to be achieved when being mounted to the foundation with supporting plates such as templates, and the reference center shaft is arranged in the anchor bolt unit in a positional relation which can realize the positional relation of the anchor bolts in the foundation when the reference center shaft is arranged on the center mark on the leveling concrete in the vertical state.

Therefore, when the anchor bolt unit is mounted to the unit mounting means, the unit mounting means positions and fixes the axial center of the reference center shaft so as to match vertically with the corresponding center mark on the leveling concrete by bringing the anchor bolt and the reference center shaft into the vertical state.

Subsequently, the anchor bolt unit is mounted to the unit mounting means via the hinge member, or the height adjusting member as needed, so that the axial center of the reference center shaft is aligned with the center mark in a state in which the anchor bolts or the like are disposed upright in the vertical state.

The anchor bolt unit is preferably provided with

auxiliary legs extended downward from the supporting plate such as the template for positioning and supporting the anchor bolts in the state described above, thereby causing them to provide an inclination preventing effect which prevents inclination more than necessary as described above.

Subsequently concrete for the base portion and the rising portion of the foundation are cast simultaneously, and the anchor bolt unit which is inclined during this operation is adjusted to the vertical state before the concrete is hardened. This can be achieved by setting the plummet instrument to the reference center shaft and moving the same, and securing its verticality. Since the reference center shaft is arranged in parallel with all the anchor bolts in the unit, the verticality of all the anchor bolts can be secured simply by correcting the reference center shaft.

The reference center shaft thus adjusted to the vertical state is maintained in its vertical state by the holding means until the concrete is hardened. The holding means may be the one described above, and hence the method of usage is the same as a matter of course. Also, as described above, since it is a holding means of simple structure, there is little possibility to be a hindrance of level adjustment or the like of the top end of the foundation. The plummet instrument may be kept in the state

of being set to the reference center shaft so that the verticality thereof can be checked out easily at the time of making the round, which is convenient.

After the concrete is hardened, the holding means is removed, and the template provided above is also removed. The reference center shaft is pulled out, or cut off at the top end level of the rising portion of the foundation. If the plummet instrument is set, it is also removed. In a case in which the reference center shaft is formed of a shaft body constituting an outer layer and a core member of a small diameter constituting an axial center thereof and is adapted to be cut at any position in the longitudinal direction, it should be cut at the top end level of the rising portion of the foundation as described above. At this time, when the reference center shaft is cut, the core member of a small diameter which constitutes the axial center appears on the end surface thereof irrespective of its cutting position in the height direction thereof, which can be used as an original point of the reference center line to be indicated on the top end of the rising portion of the foundation. This core member is preferably differentiated in color from the outer layer for better visibility.

When positioning is performed using the anchor bolt unit as described above, positioning of the plurality of

anchor bolts can be achieved effectively at once. Accurate positioning of the respective anchor bolts is totally achieved as long as the verticality of the reference center shaft is maintained, as will be understood from the description above.

In either cases described above, after casting of concrete, there is the step to be performed for restoring the anchor bolt inclined by the casting pressure of the concrete to the vertical state before the concrete is hardened, which is the most important step. When the plummet instrument including the pipe member which can be fitted on the anchor bolt or the reference center shaft as described above and the verticality measuring section provided on the upper end thereof is used, the anchor bolt or the reference center shaft to be measured must be a complete round having its center on its axial center when viewed from the top. If it is decentered, when the pipe member of the plummet instrument is fitted on the anchor bolt or the like, it is inclined in the decentered direction, and hence the accurate verticality of the anchor bolt or the like cannot be secured easily.

The reference center shaft is manufactured for this purpose, and is configured to be a complete round having its center on the axial center thereof when viewed from the top. On the other hand, as regards the anchor bolt, those

commercially available are used, and hence in many cases, screw portions at their upper end are not manufactured accurately. The outer edge of the spinning screw which constitutes the upper screw portion is partly projecting in many cases, and it does not assume a round having a center on the axial center thereof when viewed from the upper end side. Therefore, with these anchor bolts solely, whether or not they are brought into the vertical state cannot be measured accurately with the plummet instrument.

Therefore, as regards the anchor bolts, those which are processed and corrected in the factory or the like in advance so as to assume a circle having a center on the axial center in plan view for at least the portion including the upper screw portion where the pipe member of the plummet instrument is fitted so as to achieve smooth fitting on the pipe member without being decentered, and without looseness must be used. This process can be achieved by removing the portion projecting more than necessary by a turning processing or the like. The anchor bolt of a different shape can become usable after such a processing.

When the hinge member is formed of a flexible tube member having insertion joint ends at both ends, and is adapted to be connected via the volute joints inserted into the upper and lower ends thereof, the volute joints also need to have a circumference assuming a complete circle

having a center on the axial center in plan view, and is not allowed to be decentered. It is the same when the height adjusting member is employed and configured of a mechanism such as a turn buckle, and it is necessary that the upper and lower bolt members are formed without decentering and both of the bolt members are positioned accurately on the same axial center.

EXAMPLE 1

Example 1 relates to a method of positioning an anchor bolt to be installed in a concrete foundation of a wooden building and, in particular is suitable for the case of installing an anchor bolt which is required to have a high accuracy such as a hold-down anchor bolt, an anchor bolt to be installed at a portion close to a bracing, or an anchor bolt to be installed at a bed-sill joint portion. In addition, it is also suitable as a method used for positioning of all other types of anchor bolts, as a matter of course.

In a first step, a center mark for the anchor bolt to be installed is positioned and indicated on leveling concrete using this method. The leveling concrete is to be disposed within a required range in an area to establish the foundation in advance.

The center mark for the anchor bolt as described above is to be positioned directly from a reference center of a

building which is separately set and indicated on the leveling concrete, and indicated with charcoal or other marking means. This positioning can easily be achieved using a measuring instrument such as a transit instrument. It is also possible to perform this positioning using the transit instrument or the like only on a principal portion such as reference center lines of a rising portion of the foundation, and perform the positioning of the center mark or the like for the anchor bolt by measurement in reference to these reference center lines.

In this case, a method using center mark indication tapes t1-t6 as shown in Figs. 16(a) to (f) to position and indicate the center marks for the anchor bolt and a reference center shaft of an anchor bolt unit is speedy and the accurate positioning and indication are achieved. The center mark indication tapes t1-t6 have reference center lines L1, L2 to be aligned with the reference center line positioned by the transit instrument or the like, and a center mark ca for the anchor bolt and a center mark cs for the reference center shaft of the anchor bolt unit which are positioned at a predetermined relation with the reference center lines L1, L2 indicated thereon. The center mark indication tapes t1-t6 are, as will be understood from the description above, capable of positioning and indicating the respective center marks ca, ca... and cs, cs... by adhering

on the leveling concrete so that the reference center lines L1, L2 match the reference center lines positioned and indicated on the leveling concrete.

Subsequently, in Example 1, the anchor bolts are installed using the center marks ca, ca... for the anchor bolts positioned and indicated on the leveling concrete as described above. Firstly, a mounting member (anchor bolt mounting means) 1 constituted of a hollow bolt 1b with a base seat 1a is fixedly installed so as to match the corresponding center mark ca. The base seat 1a has a viewing hole 1c opening at a center as shown in Fig. 1(a) and Fig. 14, and two sector-shaped projecting strips 1d, 1d are provided so that the apexes thereof project in the viewing hole 1c so as to oppose to each other. On the outside of the hollow bolt 1b, a number of screw holes h, h... which also serve as connecting holes for adhesive agent are formed to open consecutively. Notches v of V-shape to be aligned with the reference center lines L1, L2 are formed at a center of each sides, and notched grooves m for cutting off triangular shapes from respective four corners are formed at positions near the respective corners.

An operator places the mounting member 1 on leveling concrete 2 as shown in Fig. 1(a), and views inside the viewing hole 1c from above, and positions the same while matching one or both of sides of the two sector-shaped

projecting strips 1d, 1d in the viewing hole 1c with one or both of the intersecting reference center lines L1, L2 indicated therein or a center line of only the center mark ca in question. In this manner, the hollow bolt 1b of the mounting member 1 can be installed so as to be aligned extremely accurately with the center mark ca.

Fixation of the base seat 1a of the mounting member 1 to the leveling concrete 2 is performed using adhesive agent and concrete screws 3, 3.....

Subsequently, as shown in Figs. 1(a) and (b), an anchor bolt 6 is installed upright to the hollow bolt 1b of the mounting member 1 via a hinge member 4 and a turn buckle member (height adjusting member) 5.

The hinge member 4 is, as shown in Figs. 1(a) and (b), formed of flexible tube member and is inserted and connected at an insertion joint end at a lower end with a volute joint 7a of a shaft extending upright from a center of an upper end of a ball head lock nut 7 to be screwed into the hollow bolt 1b and at an insertion joint end at an upper end with a volute joint 5d at a lower portion of a screw member 5a extending downwardly of the turn buckle member 5.

The turn buckle member 5, as shown in Figs. 1(a) and (b), includes a turn buckle member body 5b formed with female screws of opposite directions on an upper portion and a lower portion of an inner periphery thereof, and the screw

member 5a screwed into the turn buckle member body 5b from a lower end thereof, and a screw member 5c screwed into the turn buckle member body 5b from an upper end thereof. The two screw members 5a, 5c are male screw members having threads in the opposite directions from each other, corresponding to the female screws formed on the upper and lower portion of the inner periphery of the turn buckle member body 5b as a matter of course. An upper end of the upper screw member 5c is fixed to a lower end of the anchor bolt 6.

The anchor bolt 6 includes a flange member 6a for preventing coming off provided at a position immediately above a lower most portion and a male screw 6b at an uppermost position respectively and the male screw 6b has a nut 6c which is screwed thereon in advance, as shown in Figs. 1(a) and (b).

The anchor bolt 6 is installed upright on the hollow bolt 1b by connecting the turn buckle member 5 and the hinge member 4 to the lower end thereof from above in this sequence, and screwing the ball head lock nut 7 which is connected to the lower side thereof onto the hollow bolt 1b of the mounting member 1. In this manner, the anchor bolt 6 is installed upright on the corresponding center mark ca with the axial center thereof aligned vertically therewith as shown in Fig. 1(b).

Subsequently, the height of the anchor bolt 6 is adjusted by rotating the turn buckle member body 5b of the turn buckle member 5 as needed, and then concrete is cast. Example 1 is an example of the case in which concrete for both of the base portion and the rising portion are cast in one step, so called monoblock casting, and hence concrete is cast in this manner.

The anchor bolt 6 is subjected to a corresponding pressure by the casting of concrete as described above. Since the anchor bolt 6 is connected to the hollow bolt 1b of the mounting member 1 via the hinge member 4 as described above, and the hinge member 4 is formed of flexible tube member, it can be bent in any directions through 360° at this portion and hence it is inclined by the casting pressure from concrete 8 in the corresponding direction as indicated by a chain line in Fig. 2.

Since it is inclined according to the casting pressure as described above, most part of the pressure can be released at this portion, and consequently, the hollow bolt 1b and the base seat 1a connected therewith are prevented from being exerted with an external force which is larger than necessary. Therefore, the mounting member 1 can be maintained reliably in a state of initially installed on the leveling concrete 2.

Subsequently, a plummet instrument 9 is set on the

upper end of the anchor bolt 6 immediately, before the concrete 8 is hardened, and the anchor bolt 6 is restored to the vertical state while checking a verticality measuring section 9a of the plummet instrument 9 as shown in Fig. 2. Then, as shown in Fig. 3, this state is maintained by a verticality holder (holding means) 10 until the concrete 8 is hardened. The plummet instrument 9 is kept to be set on the anchor bolt 6. It is for allowing check out of the verticality when making the rounds thereafter.

The plummet instrument 9 is composed of the verticality measuring section 9a and a pipe member 9b to be fitted on the anchor bolt 6 or the like as shown in Fig. 19(a). The verticality measuring section 9a employs a structure to measure the verticality by the position of an air ball in liquid positioned at a center of an upper surface. The pipe member 9b is formed to have an inner diameter slightly larger than the outer diameter of the anchor bolt 6 to be measured and, as shown in Fig. 19(d), and the inner periphery thereof is formed with a plurality of projecting ridges extending along the axial direction over the entire inner periphery at regular angular intervals. A diameter of a circle formed by connecting apexes of the plurality of projecting ridges is set to slightly exceed the outer diameter of the anchor bolt 6 to be measured. A lower end of the pipe member 9b is formed so as to be widened

gradually downward as shown in Fig. 19(a).

As shown in Fig. 2 and Fig. 3, the plummet instrument 9 can be set to the anchor bolt 6 easily and reliably by fitting the pipe member 9b on the upper end of the anchor bolt 6. Then, after having set plummet instrument 9 as described above, the anchor bolt 6 is moved to the opposite direction from the direction of inclination, that is, toward the vertical direction, and then the verticality is checked out by the plummet instrument 9. If it is not yet in the vertical state, it is fine adjusted to the opposite direction from the direction of inclination which can be seen from the plummet instrument 9 and the verticality is checked out again. By repeating this operation several times, the vertical state of the anchor bolt 6 can be secured accurately.

As shown in Figs. 18(a) to (d), the verticality holder 10 includes two band-shaped holding strips 10a, 10a that can be bent at a center thereof, an anchor holding hole 10b opened at a center of the bending portion, and magnets 10c arranged at positions near both ends of the band-shaped holding strips 10a, 10a.

After the anchor bolt 6 is positioned in the vertical state, the verticality holder 10 is fitted on the anchor bolt 6 through the anchor holding hole 10b, and then, as shown in Fig. 3 and Fig. 18(c), the band-shaped holding

strips 10a, 10a are widened to a substantially linear state, and the magnets 10c at the both ends are fixedly attached to upper ends of concrete forms k, k on both sides, whereby the verticality of the anchor bolt 6 is maintained.

The verticality holder 10 is also able to maintain the anchor bolt 6 in the vertical state by fitting the anchor holding hole 10b on the anchor bolt 6, bending the band shaped holding strips 10a, 10a into a substantially V-shape as shown in Fig. 18(d), and fixedly attaching to the upper end of the concrete frame k on one side.

The verticality holder 10 is simply for holding the anchor bolt 6 until the concrete 8 is hardened, and is extremely simple in structure. However, it is sufficient because it is not predicted that it is subjected to a large external force during this period. Since the verticality holder 10 has such a simple structure, it will not be a hindrance when adjusting the top end level of the rising portion of the foundation.

After the concrete 8 has hardened, the verticality holder 10 and the plummet instrument 9 are removed from the anchor bolt 6. The anchor bolt 6 must be maintained in the vertical state at this moment, and if so, the axial center thereof and the center mark ca on the leveling concrete 2 must be vertically aligned. Therefore, it is positioned with a high degree of accuracy with an extremely simple

operation. Fig. 4 shows this state.

EXAMPLE 2

Example 2 relates to the method of positioning the anchor bolt 6 in the case in which the foundation is constructed by casting concrete for the base portion and the rising portion in two steps.

The procedure until the center marks ca, ca..., cs, cs... are positioned and indicated on the leveling concrete 2 is exactly the same as Example 1.

In Example 2 as well, the mounting member 1 having the hollow bolt 1b with the base seat 1a which is the same as Example 1 is installed so as to match the corresponding center mark ca. The method of positioning the mounting member 1 in this case is the same as those described in Example 1. However, in Example 2, the more accurate verticality of the hollow bolt 1b which extends upright from the mounting member 1 is required. In this case, the base seat 1a is positioned, and is temporarily fixed as shown in Fig. 6(a), and then the ball head lock nut 7 with an extension shaft 7b extending upright from an upper surface thereof is screwed into the hollow bolt 1b provided above, and then the plummet instrument 9 is set to the extension shaft 7b as shown in Fig. 6(b), and a mounting state of the base seat 1a is adjusted so that the verticality of the extension shaft 7b can be secured.

When it is found that the base seat 1a is inclined by measurement using the plummet instrument 9, a suitable plate shaped member is inserted to a required portion between a lower surface of the base seat 1a and an upper surface of the leveling concrete 2 to adjust the inclination. For example, as shown in Fig. 14, a triangular shaped portion may be cut off using the notched groove m at the corner of the base seat 1a, and used as a member to be inserted at the required portion between the lower surface of the base seat 1a and the upper surface of the leveling concrete 2. After the verticality of the extension shaft 7b is secured, the base seat 1a is fixed on the leveling concrete reliably by concrete screws, adhesive agent, or the like.

Subsequently, as shown in Fig. 7, concrete 18 for the base portion is cast. The concrete 18 for the base portion is cast to a level near immediately below an upper end of the extension shaft 7b extended upright from the ball head lock nut 7 which is screwed into the hollow bolt 1b as shown in Fig. 7. The length of the extension shaft 7b should be set to comply with such an usage condition.

In Fig. 7, the plummet instrument 9 is set at the upper end of the extension shaft 7b, and it is for checking out the verticality of the extension shaft 7b. Since the concrete 18 for the base portion is thin, the extension shaft 7b does not incline in this stage as long as it is

fixed firmly to some extent.

Subsequently, when the concrete 18 for the base portion is hardened to some extent, the anchor bolt 6 is disposed upright on the upper end of the extension shaft 7b via the hinge member 4 and the turn buckle member 5 as shown in Fig. 8. Fig. 5 shows a general image of a connected state in this case. The hinge member 4 and the turn buckle member 5 have exactly the same structures as those in Example 1. On the other hand, a volute joint 7a is configured on the upper end of the extension shaft 7b as shown in Fig. 8, and hence the anchor bolt 6 can be disposed upright by inserting and connecting the volute joint 7a into the insertion joint end at the lower end of the hinge member 4.

Then, a turn buckle member body 5b of the turn buckle member 5 is rotated as needed to adjust the length (height), and then concrete 28 for the rising portion of the foundation is cast as shown in Fig. 9.

The anchor bolt 6 is subjected to the casting pressure by the casting of the concrete 28, is inclined in the direction corresponding to the pressure at a portion of the hinge member 4 to release the casting pressure as described in Example 1. Consequently, a force more than necessary is not exerted to the extension shaft 7b, and the extension shaft 7b maintains a state in which the upper end thereof is accurately positioned vertically above the center mark ca.

Subsequently, as in the case of Example 1 and as shown in Fig. 9, immediately, that is, before the concrete 28 is hardened, the plummet instrument 9 like the one in Example 1 is set to the upper end of the anchor bolt 6 to restore the anchor bolt 6 into the vertical state while checking out with the plummet instrument 9, and the anchor bolt 6 is maintained in this state by the verticality holder 10 until the concrete 28 is hardened. The verticality holder 10 is the same as that described in Example 1, and the verticality of the anchor bolt 6 can be maintained in the same manner. The plummet instrument 9 is kept to be set on the anchor bolt 6 in this case as well.

The subsequent operation is exactly the same as the one described in Example 1, and the anchor bolt 6 must be maintained in the vertical state at this moment, and if so, as described in Example 1, the axial center thereof and the center mark ca on the leveling concrete 2 must be vertically aligned. Therefore, the anchor bolt 6 is positioned and installed on the foundation accurately with the extremely simple operation.

EXAMPLE 3

Example 3 relates to a method of positioning the anchor bolt 6 in the case in which the foundation is constructed in two steps by casting concrete for the base portion and the rising portion as in the case of Example 2, and is different

from Example 2 in the process after positioning and indication of the center marks ca, ca... and cs, cs... on the leveling concrete 2 until upright disposition and fixation of the extension shaft 7b. Since the different point is only the process described above, only the different point will be described.

As shown in Fig. 10(a), a drill d is aligned with the corresponding center mark ca on the leveling concrete 2 and a mounting hole hm is drilled. Then, as shown in Fig. 10(b), a plug member p is press fitted and fixed in the mounting hole hm. Subsequently, as shown in Fig. 10(c), a screw member 1e is provided as the anchor bolt mounting means at the lower end of the extension shaft 7b, and the extension shaft 7b provided with a flange body 1f at a boundary with the screw member 1e is installed in the mounting hole hm. This is achieved by screwing the screw member 1e into the mounting hole hm using a cross groove 7c formed on the upper end of the extension shaft 7b, as shown in Fig. 10(d). At this time, the screw member 1e is fixed by being screwed and advanced into the plug member p, as shown in Fig. 10(c).

As shown in the same drawing, the extension shaft 7b is extended upright on the corresponding center mark ca on the leveling concrete 2. Subsequently, as shown in Fig. 11, a reinforcing pipe 11 having a reinforcing flange 11a protruding from a lower end in the peripheral direction is

fitted thereon, and then as shown in Fig. 12, the plummet instrument 9 is set thereon, whereby the reinforcing flange 11a is fixed on the leveling concrete 2 while checking out the verticality of the extension shaft 7b reinforced with the reinforcing pipe 11 fitted thereon. The verticality is secured by adjustment by inserting a plate member or the like between a corresponding portion on a lower surface of the reinforcing flange 11a and a corresponding portion on the upper surface of the leveling concrete 2 as needed. Fixation of the reinforcing flange 11a is performed by using adhesive agent, concrete nails or the concrete screws 3, 3....

After the extension shaft 7b is secured to the vertical state in this manner and reinforced by the reinforcing pipe 11, the post process is performed in the procedure as described in Example 2. That is, concrete for the base portion is cast, and after the concrete is substantially hardened, the extension shaft 7b is connected to the lower end of the anchor bolt 6 via the turn buckle member 5 and the hinge member 4 (the extension shaft 7b is connected directly by inserting the volute joint 7a thereof into the insertion joint end at the lower end of the hinge member 4).

EXAMPLE 4

Example 4 relates to an example of a method of positioning and installing an anchor bolt unit 16 including

the plurality of anchor bolts 6, 6... set together on the center marks ca, ca....

As shown in Fig. 13(a), the anchor bolt unit 16 includes the plurality of anchor bolts 6, 6.. joined together using upper and lower templates 12, 12 in the same positional relation as the positional relation to be achieved when being mounted to the foundation. The upper and lower templates 12 include connecting holes opened in a positional relation corresponding to each other in the vertical direction, and portions of the anchor bolts 6, 6... near the upper and lower ends thereof are inserted therethrough, and the respective ends are fixedly tightened to their positions with nuts n, n screwed on upper and lower sides of the templates 12, 12.

The connecting hole is opened at a center of the upper template 12 of the anchor bolt unit 16, a reference center shaft 13 is passed therethrough, and is fixedly tightened with the nut n, n screwed thereto on the upper and lower sides of the template 12. The reference center shaft 13 is positioned so that the axial centers of the anchor bolts 6, 6... in the unit match vertically with the corresponding center marks ca, ca... on the leveling concrete 2 when the reference center shaft 13 is in the positional relation in which the axial center thereof is aligned vertically with the center mark cs in the vertical state.

The reference center shaft 13 includes, as shown in Fig. 13(a), a shaft body 13a which constitutes an outer layer, and a core member 13b of a smaller diameter constituting the axial center thereof. The shaft body 13a and the core member 13b are both formed of hard plastic which can be cut, and are colored in different colors from each other.

The anchor bolt unit 16 is connected to the ball head lock nut 7 screwed onto the hollow bolt 1b of the mounting member 1 via the turn buckle member 5 and a hinge member 14.

The turn buckle member 5 is the same as the one described in Example 1. The upper end of the screw member 5c screwed into the upper portion of the turn buckle member body 5b is fixedly suspended from a center of the lower template 12 of the anchor bolt unit 16. In other words, the suspending position of the screw member 5c is exactly in a vertically matching relation with the reference center shaft 13.

The hinge member 14 is formed of a flexible single-layer rubber column having joint ends at both ends, and the lower end of the screw member 5a on the lower side of the turn buckle member 5 is fixedly provided at a center of the upper joint end, and an upper surface of the ball head lock nut 7 is fixedly provided at the lower joint end of the hinge member 14.

The mounting member 1 has the same structure as that

described in Example 1. The ball head lock nut 7 is also the same as that described in Example 1.

In Example 4 as well, the procedure of the installation of the leveling concrete 2 to the positioning and indication of the center marks ca, ca...., cs, cs... thereon is to be performed in the exactly the same manner as in Examples 1 to 3 as a matter of course. The method of mounting the base seat 1a on the leveling concrete 2 is also exactly the same. However, in this case, it is mounted so as to mach the corresponding center mark cs for the reference center shaft 13, which is the only different point. It is needless to say that the way match them is also the same.

In this manner, the anchor bolt unit 16 is connected to the hollow bolt 1b of the mounting member 1 fixedly installed while matching with the corresponding center mark cs on the leveling concrete 2 via the hinge member 14 and the turn buckle member 5. This connection is, as will be understood from the description above, performed by screwing the ball head lock nut 7 connected to the lower end of the hinge member 14 onto the hollow bolt 1b. The anchor bolt unit 16 disposed upright from the hollow bolt 1b in this manner is connected by auxiliary springs 15 between the both ends of the lower template 12 and outer edges of the base seat 1a in order to keep the stable posture. This connecting is achieved by attaching hooks, not shown, to the

both ends of the temperate 12 and the outer edges of the base seat 1a in advance and engaging the springs therewith.

Subsequently, the height of the anchor bolts 6, 6... of the anchor bolt unit 16 is adjusted by rotating the turn buckle member body 5b of the turn buckle member 5 as needed, concrete for the base portion and the rising portion of the foundation is cast simultaneously, and before the concrete is hardened, the anchor bolt unit 16 which is inclined by the casting pressure of the concrete is restored to the vertical state.

This can be achieved by setting the plummet instrument 9 on the reference center shaft 13 and moving the same to secure the verticality thereof. Since the reference center shaft 13 is arranged in parallel with all the anchor bolts 6, 6... in the unit, when the reference center shaft 13 is corrected to the vertical state, the verticality of all other anchor bolts 6, 6... can be secured simultaneously. The plummet instrument 9 is the same as the one described in Example 1 and so on, and is used in the same manner.

The reference center shaft 13 adjusted to the vertical state is maintained in the vertical state by the verticality holder 10 until the concrete is hardened. The verticality holder 10 is the one described in Example 1, and is used in the same manner as the matter of course. As described above, the verticality holder 10 is simple holding means, it will

not be a hindrance when adjusting the top end level of the foundation.

After the concrete is hardened, the verticality holder 10 is removed. If the plummet instrument 9 is still set thereon, it is also removed. The upper template 12 is also removed from anchor bolts 6, 6... and the reference center shaft 13 by removing the nuts n, n.... The reference center shaft 13 is cut off at the top end level of the rising portion of the foundation.

When the positioning is performed using the anchor bolt unit 16, positioning of the plurality of anchor bolts 6, 6... can be achieved effectively at once. Accurate positioning of the respective anchor bolts 6, 6... is totally achieved accurately as long as the verticality of the reference center shaft 13 is maintained, as will be understood from the description above.

The core member 13b of a smaller diameter which constitutes the axial center appears on a sectional surface of the reference center shaft 13 which appears on the top end of the rising portion of the foundation, which corresponds to the center mark cs positioned on the upper surface of the leveling concrete 2 moved accurately upward, and hence it can be used as an original point of the reference center line to be indicated on the top end of the rising portion of the foundation.

EXAMPLE 5

This is an example of the anchor bolt mounting means to be mounted so as to match the center marks ca, cs positioned and indicated on the leveling concrete 2, and as shown in Fig. 15(a), and of a mounting member 21 of ore anchor type as shown in Fig. 15(a), in which a mounting hole is drilled at a predetermined portion of the leveling concrete 2, the mounting member 21 is inserted into the mounting hole and hammered thereon from above, a taper member 21a at a lower end is entered into a cylindrical body 21b, whereby a lower portion of the cylindrical body 21b is enlarged and fixed to the mounting hole.

A bolt member 21d provided with a volute joint 21c at an upper portion is screwed into an upper portion of the cylindrical body 21b, so that the volute joint 21c can be connected to the hinge member 4 described in Example 1 and so on. This can be used instead of the mounting member 1 formed of the hollow bolt 1b with the base seat 1a.

EXAMPLE 6

This is also an example of the anchor bolt mounting means to be mounted so as to match the center marks ca, cs positioned and indicated on the leveling concrete 2 and, as shown in Fig. 15(b), is a mounting member 31 being composed of a mounting nut 31b with a base seat 31a and having a viewing hole 31c opened at a center thereof. The viewing

hole 31c is formed with two sector-shaped projecting strips so as to project with apexes thereof opposes to each other. The base seat 31a is formed with screw holes, notches and notched grooves like on the base seat 1a in Example 1.

A bolt member 31e provided with a volute joint 31d at an upper end thereof is screwed into the mounting nut 31b, so that the volute joint 31d can be connected to the hinge member 4 described in Example 1. It can be used instead of the mounting member 1 formed of the hollow bolt 1b with the base seat 1a.

EXAMPLE 7

This is an example relating to means for supporting the anchor bolt unit 16 before casting concrete in order to stabilize the posture, and as shown in Fig. 13(b), to supporting poles 25, 25 which are fixedly provided so as to suspend from the lower template 12 which supports the anchor bolts 6, 6 while maintaining the mutual positional relation thereof. These supporting poles 25, 25 are set to such a length that lower ends can only reach positions slightly apart from the base seat 1a of the mounting member 1, and support the anchor bolt unit 16 so as to allow inclination within a certain range and avoid further inclination.

Other components of the anchor bolt unit 16 in this example are completely the same as those in Example 4.

EXAMPLE 8

This is also an example relating to means for supporting the anchor bolt unit 16 before casting concrete in order to stabilize the posture, and as shown in Fig. 13(c), to supporting poles 35, 35 which are fixedly provided so as to suspend from the same position as the previous example on the lower template 12 with dampers 35a provided in midsections thereof. The supporting poles 35, 35 are set to such a length that lower ends can only reach the base seat 1a of the mounting member 1, and support the anchor bolt unit 16 so as to allow inclination within a certain range with a resilient effect of the damper 35a and avoid further inclination.

Other components of the anchor bolt unit 16 in this example are also completely the same as those in Example 4.

EXAMPLE 9

An adaptor 19 of the plummet instrument 9 used when performing the method of accurately positioning the anchor bolt will be described.

This includes a flange body 19a protruding at a lower end and an adjusting pipe member 19b having the flange body 19a along an outer periphery of the lower end, as shown in Fig. 19(b). The adjusting pipe member 19b has an outer diameter which can be inserted into the plummet instrument 9 smoothly without looseness, and an inner diameter corresponds to the outer diameter of the anchor bolt or the

like with a small diameter which cannot be measured by the plummet instrument 9 and must be measured. More specifically, it is formed so as to be slightly larger than the outer diameter of the object to be measured having a small diameter and, as shown in Fig. 19(e), is formed with a plurality of projecting ridges extending from the inner periphery thereof along the axial direction over the entire inner periphery at regular angular intervals. In this case, a diameter of a circle formed by connecting apexes of the plurality of projecting ridges is set to slightly exceed the outer diameter of the object to be measured with a small diameter.

The lower end of the adjusting pipe member 19b is formed into a shape widened gradually downward, as shown in Fig. 19(b).

This adaptor 19 is, therefore, used by inserting the adjusting pipe member 19b into the pipe member 9b of the plummet instrument 9, as shown in Fig. 19(c). Fig. 20(a) shows a sate in which the pipe member 9b of the plummet instrument 9 is directly fitted on the reference center shaft 13 with a large diameter without using the adapter 19, and Fig. 20(b) shows a state in which the plummet instrument 9 having the adapter 19 set thereon is fitted on the upper end of the anchor bolt 6 with a small diameter. The anchor bolt 6 with a small diameter or the like can be set without

looseness by setting the adapter 19 and fitted on the latter adjusting pipe member 19b, so that further accurate measurement of the verticality is enabled.

EXAMPLE 10

An inspection tool for the plummet instrument 9 used when performing the method of accurately positioning the anchor blot will be described.

The inspection tool 29 includes, as shown in Fig. 17(a), a disc-shaped float 29a, a set shaft 29b extended upright from a center of an upper portion thereof, and a plumb bob shaft 29c suspended from a center of a lower portion of the float 29a.

The float 29a is floated in water in an appropriate water container, and then the plummet instrument 9 to be inspected is set to the set shaft 29b on an upper side thereof and, if the verticality measuring section 9a indicates verticality in a state in which the inspection tool 29 is stable state, the plummet instrument 9 can be determined to be normal. It is suitable for inspecting a number of plummet instruments 9 before use.

EXAMPLE 11

Another inspection tool for the plummet instrument 9 used when performing the method of accurately positioning the anchor bolt will be described.

The inspection tool 39 includes, as shown in Fig. 17(b),

a band-shaped base plate 39a, an universal joint mechanism 39b provided near one end thereof, a set shaft 39c extending upright with the intermediary of the universal joint mechanism 39b, and a plumb bob shaft 39d extending downward via the universal joint mechanism 39b.

An end of the base plate 39a is mounted to an appropriate portion and the universal joint mechanism 39b side is kept up in the air, the plummet instrument 9 to be inspected is set on the set shaft 39b on an upper side thereof and, if the verticality measuring section 9a indicates verticality in a state in which the universal joint mechanism 39b is kept in a stable state, the plummet instrument 9 can be determined to be normal. It is convenient for inspecting a number of plummet instruments 9 before use.

Industrial Applicability

The present invention can achieve accurate positioning of an anchor bolt on the foundation in a simple procedure using members of an extremely simple structure without using a temporary reference construction, when building a foundation for a building, and may be utilized effectively in the industrial field in which various buildings are constructed.